REPORT: Silicon wafer cutting by Laser-MicroJet®

for Anonymous

by Stéphane Delahaye; Synova SA

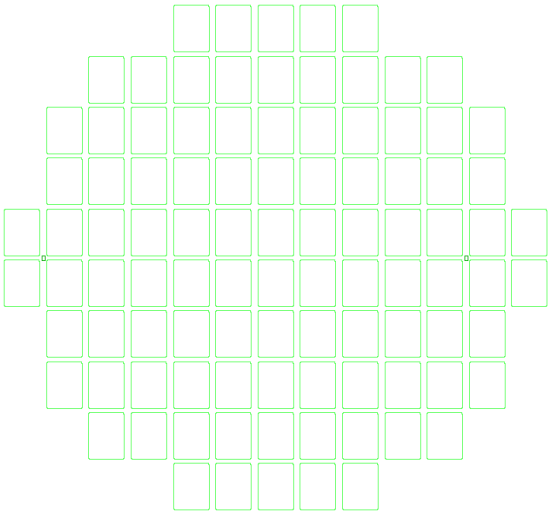
TASK

The Laser-MicroJet® technology has been tested for cutting 200 mm Silicon wafers.
The goal was to check the feasibility of making silicon interposer into 500 µm thick silicon wafers.
As the processed wafers were very fragile another trial has been done on a thicker (~750 µm) silicon wafer.

SAMPLE DESCRIPTION AND PREPARATION

SAMPLE	Material	Si
	Dimension	200 *mm*
	Thickness	500 *µm*
	Quantity	4 *pcs*

Release of application report			
Project Leader		Responsible Application Group	
Name:	Stephane Delahaye	Name:	Dr Benjamin Carron
Date:	03.08.2012	Date:	03.08.2012
Visum:	SD	Visum:	BC



Picture 1: Drawing used for the cut

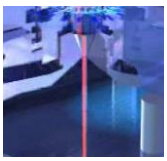
PROCESS: INSTRUMENT & TEST PARAMETERS

For these experiments, the LDS 200M equipped with a frequency-doubled Q-switched Nd:YAG laser has been used as the machine configuration in our lab.
It is a manually loaded machine, allowing to cut, drill, groove, scribe, trench, mark, or grind wafers of any kind of semiconductor material.

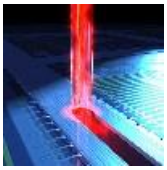
Major advantages of Laser-MicroJet® technology with regards to your application are:

- Cutting of arbitrary shapes
- No chipping on front side, minimal chipping on backside
- Negligible heat damage to the material
- Negligible contamination / re-deposition
- Advantageous process rates

In the table below, the optimized processing parameters used in the experiments are summarized:

	**SYSTEM**	Machine type	LDS 200M
	**MICROJET® PARAMETER**	Nozzle diameter	50 *µm*
		MicroJet® diameter	~42 *µm*
		Water pressure	250 *bar*
		Assist gas	He

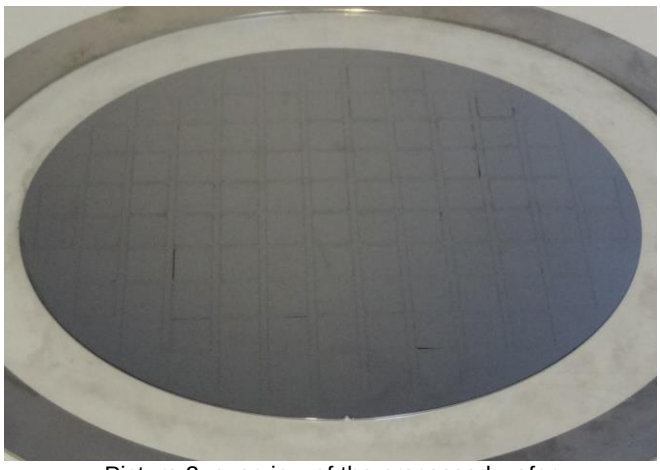
LASER PARAMETER		
Laser type	L51G	
Wavelength	532	*nm*
Pulse frequency	15	*kHz*
Average power	~30	*W*



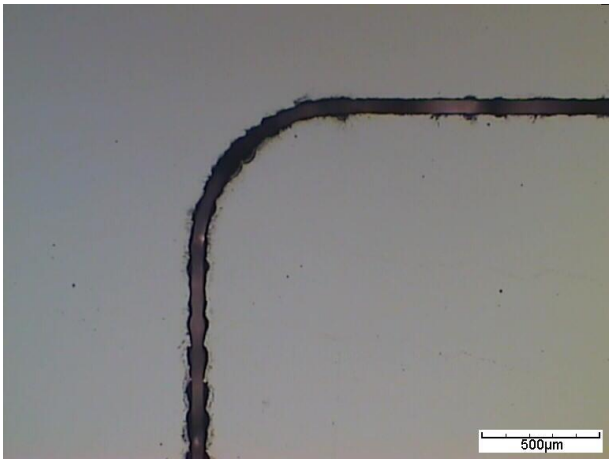
CUTTING PARAMETER		
Cutting speed	60	*mm/s*
Number of passes	~26	
Overall speed	~2.3	*mm/s*
Tape	ADWILL D520-T	

RESULTS

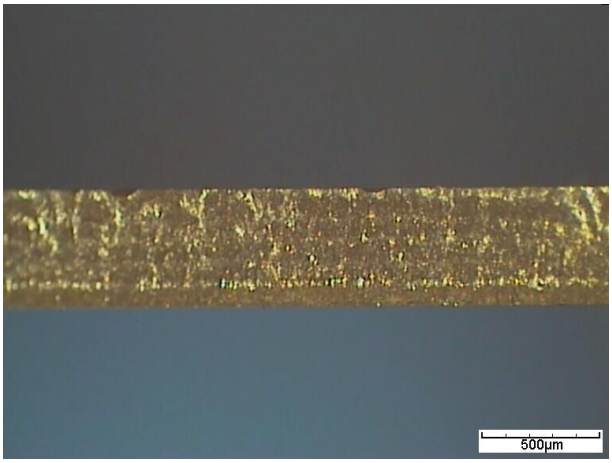
The following microscope picture give an overview on the quality obtained with the Laser-Microjet® technology.



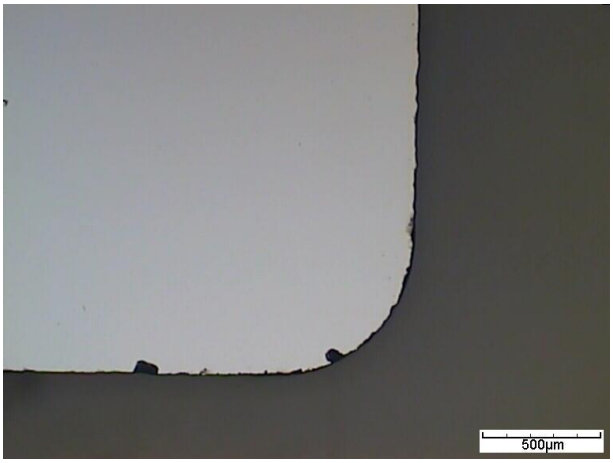
Picture 2: overview of the processed wafer



PICTURE 3: Microscope image of the frontside (dark field illumination)



PICTURE 4: Microscope image of the sidewall (dark field illumination)



PICTURE 5: Microscope image of the backside (dark field illumination)

The table below summarises Anonymous expectations and our results.

	What are your priorities? (please put a cross)	Quantified expectations or improvements
Speed / throughput:	*	~ 55 min / wafer
Heat-damage free:	*	No feat affected zone
Chipping/Cracks:	*	Some chipping on the backside is visible

CONCLUSION

The cutting of 500 µm thick Silicon wafers was investigated on SYNOVA LDS 200M. This machine is based on the MicroJet® technology and combines the advantages of the high energy pulsed laser with a hair-thin water jet. While the laser is used for material ablation, the water jet is used for guiding the laser light, cooling the edges and preventing the sample from particle contamination, advantages that are essential for cutting Silicon wafers with high quality.

These tests show that:

- Good cutting quality is achievable.
- Processed wafers are very fragile and must be handle with particular care.

We thank you for your interest in our technology and we hope our results meet your requirements. Our sales agency will contact you soon to obtain a feedback about the analysis of these results and to discuss with you the further steps.